REMARKS/ARGUMENTS

The Office Action mailed February 13, 2004, has been reviewed and the comments therein were carefully considered. Claims 1-8, 13-19, 21-25, and 27-30 remain pending. Claims 9-12, 20, 26, and 31-33 are cancelled. Claims 34-38 are new. No new matter has been added. Reconsideration and allowance of this application are respectfully requested.

Claim Rejections - 35 USC § 103

Claims 1-7, 16-19, 21, 23-25, and 27-30 were rejected under 35 U.S.C. 103(a) as being unpatentable over Gulick (U.S. Patent 6,421,702) in view of Nakamura (U.S. Patent 5,437,047) in view of Reiffin (U.S. Patent 6,330,583).

Claim 1 is directed to a method of scheduling CPU resources comprising the steps of: using a counter to determine when to allocate the CPU resources; instructing an interrupt controller, via non-maskable interrupts from the counter, to allocate the CPU resources; and instructing the CPU to allocate resources in real-time by the interrupt controller issuing non-maskable interrupts to the CPU.

Gulick, Nakamura, and Reiffin, either alone or in combination, do not establish prima facie obviousness of claim 1 because they do not disclose use of non-maskable interrupts as recited in claim 1. Gulick is characterized in the office action as disclosing: a method of scheduling CPU resources by: (1) using a counter to determine when to allocate the CPU resources; and (2) instructing the CPU to allocate resources in real-time. Nakamura is characterized in the office action as disclosing the step of allocating CPU resources via non-maskable interrupts issued from a counter.

Applicant respectfully disagrees with this characterization of the respective teachings of Gulick and Nakamura. In contrast to the invention recited in Claim 1, Gulick discloses real-time interrupts that cause an operating system to provide execution time slices for pending isochronous (i.e., time-dependent) tasks. Each application informs the operating system of an execution rate and a maximum duration of its isochronous tasks. The operating system includes a non-maskable interrupt to terminate isochronous tasks. Termination is necessary when an isochronous task fails to finish executing within its specified maximum duration. (Abstract).

Gulick discloses use of non-maskable interrupts only for terminating isochronous tasks that fail to finish executing within their specified maximum duration. (Col. 11, lines 3-23). Such termination of isochronous tasks is different than preemption of tasks. (See Gulick, col. 10, lines 39-46, "It is noted that termination is distinct from preemption. Preemption is the normal suspending of a task so that another task may begin executing. For example, in FIG. 4, Task A is preempted to allow Task B to execute. Termination is the stoppage of a task due to an unexpected condition. For example, a task may continue execution beyond the duration specified for the task.")

Nakamura discloses a system for gathering and safeguarding program-run information of individual processors in a multi-processor system by transferring information to external storage. (Abstract). Each of the processors is periodically provided with a non-maskable timer interrupt. (Col. 3, lines 14-20). Respective corresponding interrupt handlers collect context information about the programs being run by the processors and store the collected information in shared memory. (Col. 3, line 62 through col. 4, line 14).

The Office Action states that it would have been obvious to one of ordinary skill in the art to combine Gulick with Nakamura "since the disclosure of Gulick fails to specify the type of interrupt that is issued by the timer." (Office Action, page 3). This rationale does not set forth a convincing line of reasoning as to why a person of ordinary skill in the art would be motivated to modify the system disclosed by Gulick as proposed in the Office Action. In other words, Gulick's silence as to the type of interrupt issued by the timer would not motivate one of ordinary skill to substitute the non-maskable interrupts from Nakamura into the system disclosed by Gulick.

The Office Action states that Gulick discloses using non-maskable interrupts issued from the operating system to preempt an executing task by a higher priority task. (Office Action, paragraph 7). Gulick does not, however, disclose, teach, or suggest using non-maskable interrupts to preempt execution of a task by execution of a higher-priority task. The Abstract of Gulick states, "an isochronous task may be preempted to execute a higher priority task. The operating system may include two types of time-slices. Higher priority tasks are allocated to quick slices and lower priority tasks are allocated to standard slices. Standard slices are preemptable and quick slices are not preemptable." (See also col. 9, line 15 through col. 10, line 34.) Gulick, therefore, discloses using non-maskable interrupts for terminating execution of isochronous tasks that fail to execute within their specified maximum duration. But Gulick does not disclose using non-maskable interrupts issued from the operating system to preempt an executing task by a higher priority task.

The Office Action then states that the function of the non-maskable interrupt issued by the operating system is similar to the interrupt issued by the timer "i.e., to terminate or preempt

the executing task in favor of another task or higher priority task." (Office Action, page 4). Gulick explains, however, that the termination of tasks is distinct from preemption of tasks. (Col. 10, lines 39-46).

The Office Action states that "it would be beneficial to specify that the interrupt issued by the timer is also non-maskable, such that it is guaranteed that the interrupt service routine is executed." (Office Action, paragraph 7). Applicant respectfully disagrees because this proposed modification would render the system of Gulick unsatisfactory for its intended purpose, which is ensuring timely execution of isochronous tasks, such as audio, video, and telephony-processing tasks. Perceptible errors, such as gaps or altered frequencies in audio signal, blank screens or lines in video signals, and echoes in telephony, may be caused if isochronous tasks are not timely executed. (Col. 1, lines 23-40). The system disclosed by Gulick controls execution of isochronous tasks from within an interrupt service routine that services a maskable interrupt. (Figure 7; col. 12, lines 51-59; abstract). Substituting a non-maskable interrupt, as proposed in the office action, for the maskable interrupt disclosed by Gulick would cause the isochronous tasks to be unable to use the operating system for obtaining and processing audio, video, and telephony data. (Nakamura, col. 4, lines 4-27). Such a loss of the ability to use the operating system would render the system of Gulick unsatisfactory for its intended purpose. For these reasons, the teachings of Gulick and Nakamura are insufficient to establish prima facie obviousness of claim 1. (MPEP § 2143.01 citing *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984)).

Paragraph 44 of the Office Action provides additional purported motivation for combining Gulick and Nakamura. Paragraph 44 is apparently based on an assumption that

setting the "preemption flag" disclosed by Gulick disables all interrupts. Gulick does not, however, disclose that setting the preemption flag disables all interrupts. Instead, Gulick discloses that a lower-priority task may be made non-preemptible, such as by the operating system giving the task a higher priority, based on the preemption flag being set. (Col. 9, lines 34-43). Accordingly, the motivation for using non-maskable interrupts in Nakamura (i.e., because operating-system-kernel information is sometimes in accessible when all interrupts are disabled) does not apply to the situation in Gulick in which a lower-priority task is made non-preemptible.

According to the Office Action, "the combination of Gulick and Nakamura provides issuing a non-maskable interrupt from a timer (or counter) to preempt an executing task." (Office Action, paragraph 7). As discussed above, Gulick does not disclose using non-maskable interrupts to preempt an executing task. Nakamura discloses using non-maskable interrupts for gathering and storing program-execution information from processors in a multi-processor environment. Accordingly, Gulick and Nakamura, either alone or in combination, fail to teach or suggest issuing a non-maskable interrupt from a timer (or counter) to preempt an executing task for the purpose of scheduling resources in real time.

Applicants respectfully disagree with the purported motivation provided in paragraph 7 of the office action for combining Reiffin with the proposed combination of Gulick and Nakamura. As explained above, Gulick does not "teach an operating system issuing a non-maskable interrupt to the CPU in order to preempt a lower priority task with a higher priority task." (Office Action, paragraph 7). Applicant also respectfully disagrees with the assertions in

paragraph 7 of the office action that follow—and are based on—the statement from paragraph 7 quoted above.

Accordingly, Gulick, Nakamura, and Reiffin, either alone or in combination, do not teach or suggest use of non-maskable interrupts as recited in claim 1, namely, instructing an interrupt controller, via non-maskable interrupts from a counter, to allocate CPU resources, and instructing the CPU to allocate resources in real-time by the interrupt controller issuing non-maskable interrupts to the CPU.

For at least the reasons discussed above, Claim 1 is in condition for allowance. Claims 2-8 ultimately depend from claim 1 and are allowable for at least the same reasons as claim 1.

Independent claims 13, 16, 19, and 34 contain limitations directed to the use of non-maskable interrupts that are similar to the limitations discussed above in connection with claim 1. Accordingly, applicant respectfully submits that claims 13, 16, 19, and 34 contain patentable subject matter and are in condition for allowance for at least reasons similar to those discussed above in connection with claim 1. Claims 14-15, 17-18, 21-25, 27-30 and 35-38, properly depend upon at least one of independent claims 13, 16, 19, and 34 and are, therefore, also in condition for allowance.

CONCLUSION

If any fees are required or if an overpayment is made, the Commissioner is authorized to debit or credit our Deposit Account No. 19-0733, accordingly.

All rejections having been addressed, applicant respectfully submits that this application is in condition for allowance, and respectfully requests issuance of a notice of allowance.

Respectfully submitted,

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